

The University of Western Ontario
Faculty of Engineering
SCHOOL OF BIOMEDICAL ENGINEERING
BME 3303b – Cellular Systems Engineering

Course Outline 2025-2026

This course will focus on the cell as the basic unit of all tissues and organs. Our primary aims are to utilize our understanding of cells and their biomechanical interactions with their environment to bioengineer physiologically relevant tissue and organ models (biomimetics) of health/disease, or tissues/organs for transplant purposes. Students will learn to integrate engineering design principles with knowledge of applied cellular and molecular biology to characterize, understand and optimize cellular responses within 3-D engineered microenvironments. The course will cover different areas of cell engineering in biomedicine, including (1) Introduction to cellular engineering, (2) Cellular mechanobiology and interactions with the extra-cellular environment, (3) Understanding cellular responses, (4) Microscale technologies for cell and tissue engineering, (5) Types and properties of scaffolds for cell engineering, (6) Measuring cell force and stiffness, (7) Genetic engineering of cells, (8) Cell culture in bioreactors and (9) Diverse biomedical applications of engineered cells, including with stem cells. *Check the 2026 Course Calendar file in Brightspace Content for all the details on lecture and lab schedule.*

Pre-requisites:

BME 3201A/B, Biology 1002B or the former 1202B, Biochemistry 2280A.

Unless you have the prerequisites for this course or written special permission from your Dean to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

Co-requisites: None

Contact Hours: 3 lecture hours (Monday), 1.5+1.5 laboratory hours (Friday), 0.5 course.

Instructor:

Teaching Assistants:

Office Hours: By appointment (in person, or using Zoom)

Course Notes and Lab Handouts:

Course notes and lab handouts will be available on the course's Brightspace site.

Lab: Attendance and participation are required for all the laboratories. If you have issues that will impede your ability to participate in labs, please discuss with the course instructor at the beginning of the course.

Recommended Text: There is no required textbook for this course, however suggested text book is: By Michael R. King, editor. Principles of Cellular Engineering- understanding the biomolecular interface (2006). Elsevier Inc. ISBN 978-0-12-269392-1.

Course Learning Objectives: This course is intended to introduce Engineering students to the fundamental concepts underlying cellular engineering and their applications in medicine. Following completion of this course, students will be able to:

- Understand the biological and engineering concepts and theories
- Understand the cellular engineering methodologies and techniques
- Analyze and logically interpret data
- Recognize strengths and limitations different cellular engineering techniques and approaches, and interpret data accordingly
- Communicate their observations with clarity and accuracy, align and compare observations with theory, describe results accurately and draw conclusions clearly and appropriately
- Demonstrate basic laboratory skills and expertise with cell culture and cellular engineering techniques.

Evaluation:

The final course mark will be determined as follows:

2 Quizzes (5% each, MCQ)	10%
Active Participation in Class and Lab	5%
2 Laboratory Reports	20%
1 Presentation (in group)	10%
1 Mid-term Test (MCQ)	20%
1 Final Exam (MCQ + short answer questions)	35%

* The quizzes, midterm and final exam will be **closed book**.

Note: Students must turn in ALL lab reports to pass this course.

Activities in which collaboration is permitted:

- Selected Lab reports (You will be notified when group work is allowed)
- Lab activities (in person)
- Class Presentation

Activities in which students must work alone (collaboration is not permitted):

- Quiz, Mid-term and final tests.

Repeating All Components of the Course:

In accordance with Senate and Faculty Policy, students who have failed an Engineering course (i.e. <50%) must repeat all components of the course. No special permissions will be granted enabling a student to retain laboratory, assignment or test marks from previous years. Previously completed assignments and laboratories cannot be resubmitted for grading by the student in subsequent years.

Use of English:

In accordance with Senate and Faculty Policy, students may be penalized up to 10% of the marks on all assignments, tests, and examinations for the improper use of English. Additionally, poorly written work with the exception of the final examination may be returned without grading. If resubmission of the work is permitted, it may be graded with marks deducted for poor English and/or late submission.

Attendance

Attendance at all lectures and laboratories is mandatory. Any student who, in the opinion of the instructor, is absent too frequently from class or laboratory periods in any course, will be reported to the Dean (after due warning has been given). On the recommendation of the Department concerned, and with the permission of the Dean, the student will be debarred from taking the regular examination in the course.

Cheating

University policy states that cheating is a scholastic offence. The commission of a scholastic offence is attended by academic penalties, which might include expulsion from the program. If you are caught cheating, there will be no second warning (see Scholastic Offence Policy in the Western Academic Calendar).

Plagiarism

Students must write their essays and assignments in their own words. Whenever students take an idea, or a passage from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. Plagiarism is a major academic offence (see Scholastic Offence Policy in the Western Academic Calendar).

The University of Western Ontario has software for plagiarism checking. Students may be required to submit their work in electronic form for plagiarism checking.

Conduct:

Students are expected to arrive at lectures on time, and to conduct themselves during class in a professional and respectful manner that is not disruptive to others.

Sickness and Other Problems:

Students should immediately consult with the Undergraduate Services if they have any problems that could affect their performance in the course. Where appropriate, the problems should be documented (see attached). The student should seek advice from the Instructor or Associate Chair (Graduate) regarding how best to deal with the problem. Failure to notify the Instructor or Associate Chair (Graduate) immediately (or as soon as possible thereafter) will have a negative effect on any appeal.

Please contact the course instructor if you require material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 x 82147 for any specific question regarding an accommodation.

Notice: Students are responsible for regularly checking their email and notices posted on the dedicated Brightspace site.

Consultation: Students are encouraged to discuss problems with their instructor by appointment. When needed, office hours will be arranged for the students to see the instructor and teaching assistants. Individual consultation can also be arranged by appointment with the instructor.

Accreditation (AU) Breakdown

Science = 60%
Engineering Science = 40%

General Learning Objectives (CEAB Graduate Attributes):

Knowledge Base	✓	Use of Engineering Tools		Impact on Society and the Environment	
Problem Analysis	✓	Individual and Teamwork	✓	Ethics and Equity	
Investigation		Communication Skills	✓	Economics and Project Management	
Design		Professionalism		Life-Long Learning	✓

EXTRA COURSE INFORMATION

Policy Framework: Missed Classes, Late Work, and Academic Integrity

I. Absence/Late Accommodation Policy

1. Students must familiarize themselves with the University Policy on Academic Consideration –

Undergraduate Students in First Entry Programs posted on the Academic Calendar:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/academic_consideration_Sep24.pdf

This policy does not apply to requests for Academic Consideration submitted for attempted or completed work, whether online or in person. The policy also does not apply to students experiencing longer-term impacts on their academic responsibilities. These students should consult [Accessible Education](#).

2. Students missing a test/assignment/lab or examination will report the absence by submitting Academic Consideration Request form through [STUDENT ABSENCE PORTAL](#).
3. **All requests for Academic Considerations must be made within 48 hours after the assessment date or submission deadline. All Academic Consideration requests must include supporting documentation. However, recognizing that formal documentation may not be available in some extenuating circumstances, the policy allows students to make one Academic Consideration request without supporting documentation in this course. However, the following assessments are excluded from this, and therefore always require formal supporting documentation:**
 - **Examinations scheduled during official examination periods.**
 - **Midterm Tests and other designated assessments as noted on the course outline.**
 - **Any assessment already covered by a flexible deadline.**

- **If a student mistakenly submits their one allowed Academic Consideration request without supporting documentation for the assessments listed above that do not require academic consideration, the request cannot be recalled and reapplied. This privilege is forfeited.**
- 4. **Requests without supporting documentation are limited to one per term per course.**
- 5. **An undocumented absence is only valid for a 24-hour period, from midnight on the day specified to midnight of the following day.** An appropriate use of an undocumented absence would be for an in-class assessment that takes place that day. Where the time given to complete the assessment is longer than 24 hours, an undocumented absence will not cover a student for the full time given to complete the assessment, and flexibility considerations in submitting the assessment will override the undocumented absence.
- 7. NOTE: Forged notes and certificates will be dealt with severely. To submit a forged document is a scholastic offence.
- 8. It is the student's responsibility to check the date, time and location of the [Special Examination](#).

II. Religious Accommodation

When scheduling unavoidably conflicts with religious holidays, which (a) require an absence from the University or (b) prohibit or require certain activities (i.e., activities that would make it impossible for the student to satisfy the academic requirements scheduled on the day(s) involved), no student will be penalized for absence because of religious reasons, and alternative means will be sought for satisfying the academic requirements involved. If a suitable arrangement cannot be worked out between the student and instructor involved, they should consult the appropriate Department Chair and, if necessary, the student's Dean.

It is the responsibility of such students to inform themselves concerning the work done in classes from which they are absent and to take appropriate action.

III. Academic Integrity

In the Faculty of Engineering, we encourage students to create a culture of honesty, trust, fairness, respect, responsibility, and courage, befitting the professional degree you are pursuing.

Please visit [Academic Integrity Western Engineering](#) for more information

IV. Academic Offences

Plagiarism means using another's work without giving credit. The university has rules against plagiarism and other scholastic offences. Western Engineering has a zero-tolerance

policy on plagiarism. The minimum penalty is zero on the course work and a repeat offence will earn you zero on the course. A third offence may lead to expulsion from the university. [Scholastic Discipline for Undergraduate Students & Cheating, Plagiarism and Unauthorized Collaboration: What Students Need to Know](#)

Students must write their reports, essays and assignments in their own words. Whenever students take an idea or a passage from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. University policy states that cheating, including plagiarism, is a scholastic offence. The commission of a scholastic offence is attended by academic penalties, which might include expulsion from the program. If you are caught cheating, there will be no second warning.

All required papers may be subject to submission for textual similarity review to commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted will be included as source documents on the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between the University of Western Ontario and Turnitin.com (<http://www.turnitin.com>). Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, in the relevant section of the Academic Handbook: http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_under_grad.pdf

V. Faculty of Engineering AI Policy

The use of generative Artificial intelligence (GenAI) tools won't be discouraged in the Faculty of Engineering. As we pride ourselves on building the future we can't hide from the use of GenAI tools to contribute to the understanding of the course materials. You are able to use GenAI tools as follows:

- For any written assignment, except take-home exams and personal reflections, you may use a GenAI tool to help you brainstorm or frame your initial ideas and grammar. However, your final submission must be entirely in your own words and demonstrate your individual experience and insight.
- For any written or practical project AI tools may be used across your workflow. Use them responsibly and reflect in your final presentation on how these tools supported or challenged your creative thinking.
- All GenAI tools used at any point of the course with the intent of helping with homework, assignments or any other assessment content must be disclosed and referenced appropriately.

GenAI tools use won't be permitted in any type of examination or other assessments where the faculty have prohibited their use. If use of GenAI tools is detected by the instructor in these instances, academic offences penalties might be imposed against the student.

VI. Accessibility

Western is committed to achieving barrier free accessibility for persons with disabilities studying, visiting and working at Western. As part of this commitment, there are a variety of services, groups and committees on campus devoted to promoting accessibility and to ensuring that individuals have equitable access to services and facilities. To help provide the best experience to all members of the campus community, please visit the [Accessibility Western University](#) for information on accessibility-related resources available at Western.

Students with disabilities may arrange for academic accommodation at Western. For a more detailed explanation, please visit [Academic Support & Engagement -Academic Accommodation](#).

VII. Inclusivity, Diversity, and Respect

The Faculty of Engineering at Western University is committed to creating equitable and inclusive learning environments that value diverse perspectives and experiences. We recognize that university courses often marginalize students based on social identity characteristics such as, but not limited to, Indigeneity, race, ethnicity, nationality, ability, gender identity, gender expression, sexuality, age, language, religion, and socioeconomic status. Understanding this, we strive to facilitate equitable experiences and inclusion within the classroom by respecting and integrating multiple ways of knowing, being, and doing. Please visit the [Office of Equity, Diversity and Inclusion](#).

VIII. Health and Well-Being

- [Health & Wellness Services – Students](#) - Offers appointment-based medical clinic for all registered part-time and full-time students.
- [Mental Health Support](#) - Provides professional and confidential services, free of charge, to students needing assistance to meet their personal, social and academic goals. Services include consultation, referral, groups and workshops, as well as brief, change-oriented psychotherapy.
- [Crisis Support](#) - For immediate assistance, please visit Thames Hall Room 2170 or call 519-661-3030. The crisis clinic operates between 11:00 am - 4:30 pm. For after-hours crisis support, click [here](#).
- [Gender-Based Violence and Survivor Support](#) - “Western is committed to reducing incidents of gender-based and sexual violence (GBSV) and providing compassionate support to anyone who is going through or has gone through these traumatic events. If you are experiencing or have experienced GBSV (either recently or in the past), you will find information about support services for survivors, including emergency contacts at the following website:
https://www.uwo.ca/health/student_support/survivor_support/gethelp.html.
To connect with a case manager or set up an appointment, please contact support@uwo.ca.

Important Contacts

<u>Engineering</u>	SEB	519-	engugrad@uwo.ca
<u>Undergraduate</u>	2097	661-	
<u>Services</u>		2130	
<u>Office of the</u>	WSSB	519-	
<u>Registrar/Student</u>	1120	661-	
<u>Central</u>		2100	

Important Links

- [WESTERN ACADEMIC CALENDAR](#)
- [ACADEMIC RIGHTS AND RESPONSIBILITIES](#)
- [ENGINEERING PROGRESSION REQUIREMENTS AND ACADEMIC REGULATIONS](#)
- [UNIVERSITY STUDENTS' COUNCIL \(USC\) - SERVICES](#)
- [IMPORTANT DATES AND DEADLINES](#)
- [ACADEMIC CONSIDERATION FOR MEDICAL ILLNESS - UNDERGRADUATE STUDENTS](#)
- [ACCOMMODATIONS FOR RELIGIOUS HOLIDAYS](#)
- [SCHEDULING OF ASSIGNMENTS, TESTS, AND EXAMINATIONS](#)
- [STUDENT FORMS](#)
- [OFFICE OF THE REGISTRAR](#)
- [RETENTION OF ELECTRONIC VERSION OF COURSE OUTLINES \(SYLLABI\)](#)
- [ACADEMIC APPEALS](#)
- [STUDENT ABSENCE PORTAL](#)

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